which Descartes was revealing the laws of motion, and Harvey the circulation of the blood. But to the mass of men this great change was all but imperceptible; and it was the energy, the profound conviction, the eloquence of Bacon, which first called the attention of mankind as a whole to the power and importance of physical research. It was he who by his lofty faith in the results and victories of the new philosophy nerved its followers to a zeal and confidence equal to his own. It was he who above all gave dignity to the slow and patient processes of investigation, of experiment, of comparison, to the sacrificing of hypothesis to fact, to the single aim after truth, which was to be the law of modern science. But, in England at least, Bacon stood—as we have said—before his age. The beginnings of physical science were more slow and timid there than in any country of Europe. Only two discoveries of any real value came from English research before the Restoration; the first, Gilbert's discovery of terrestrial magnetism in the close of Elizabeth's reign; the next, the great discovery of the circulation of the blood, which was taught by Harvey in the reign of James. But apart from these illustrious names, England took little share in the scientific movement of the Continent; and her whole energies seemed to be whirled into the vortex of theology and politics by the Civil War. But the war had not reached its end when a little group of students were to be seen in London, men 'inquisitive,' says one of them, 'into natural philosophy and other parts of human learning, and particularly of what hath been called the New Philosophy . . . . which from the times of Galileo at Florence, and Sir Francis Bacon (Lord Verulam) in England, hath been much cultivated in Italy, France, Germany, and other parts abroad, as well as with us in England.' The strife of the time indeed aided in directing the minds of men to natural inquiries. 'To have been always tossing about some theological question,' says the first historian of the Royal Society, Bishop Sprat, 'would have been to have made that their private diversion, the excess of which they disliked in the public. To have been eternally musing on civil business and the distresses of the country was too melancholy a reflection. It was nature alone which could pleasantly entertain them in that estate.' Foremost in the group stood Doctors Wallis and Wilkins, whose removal to Oxford, which had just been reorganised by the Puritan Visitors, divided the little company into two societies. The Oxford society, which was the more important of the two, held its meetings at the lodgings of Dr. Wilkins, who had become Warden of Wadham College, and added to the names of its members that of the eminent mathematician, Dr. Ward, and that of the first of English economists, Sir William Petty. 'Our business,' Wallis tells us, 'was (precluding matters of theology and State affairs) to discourse and consider of philosophical inquiries and such as related thereunto, as Physick, Anatomy, Geometry, Astronomy, Navigation, Statics, Magnetics, Chymicks, Mechanicks, and Natural Experiments: with the state of these studies, as then cultivated at home and abroad. We then discoursed of the circulation of the blood, the valves in the *venæ lacteæ*, the lymphatic vessels, the Copernican hypothesis, the nature of comets and new stars, the satellites of Jupiter, the oval shape of Saturn, the spots in the sun and its turning on its own axis, the inequalities and selenography of the moon, the several phases of Venus and Mercury, the improvement of telescopes, the grinding of glasses for that purpose, the weight of air, the possibility or impossibility of vacuities, and nature's abhorrence thereof, the Torricellian experiment in quicksilver, the descent of heavy bodies and the degree of acceleration therein, and divers other things of like nature.'

"The other little company of inquirers, who remained in London, was at last broken up by the troubles of the Second Protectorate; but it was revived at the Restoration by the return to London of the more eminent members of the Oxford group. Science suddenly became the fashion of the day. Charles was himself a fair chemist, and took a keen interest in the problems of navigation. The Duke of Buckingham varied his freaks of rhyming, drinking, and fiddling, by fits of devotion to his laboratory. Poets like Denham and Cowley, courtiers like Sir Robert Murray and Sir Kenelm Digby, joined the scientific company to which in token of his sympathy with it the king gave the title of 'The Royal Society.'"

The maps, and without maps no history ought to be tolerated, will be found greatly useful. Should Mr. Green utilise the large amount of material he must have collected for the purpose of writing a similar history on a much larger scale, no doubt he will say something about the physical environment of the English people,—those external conditions which have had their own share in shaping the history and character of our nation. His present work ought to become the school history of England.

FEHLING'S NEW CHEMICAL DICTIONARY

Neues Handwörterbuch der Chemie. Unter Mitwirkung von Bunsen, Fittig, Fresenius, &c. Bearbeitet und redigirt von Dr. Hermann v. Fehling, Professor der Chemie in Stuttgart. Erster Band. (Braunschweig: Druck und Verlag von Friedrich Vieweg und Sohn, 1874.)

TEN years have passed since the completion of the great work of Liebig, Poggendorff, and Wöhler, the "Handwörterbuch der Reinen und Angewandten Chemie." These years have witnessed great changes in our chemical knowledge; not only have theories which in the year 1864 occupied but an inferior place in the general system of chemistry now come to the front, but also a vast array of new facts demands a place in the system, which must therefore be extended so as to include them all.

The book which ten years ago was looked upon by all as a standard authority has now necessarily become somewhat antiquated, and the desire for a new edition has naturally arisen in the minds of the German chemists. The first fruits of this desire we have now in the goodly volume of 1,200 pages which lies before us.

As in most of the productions of the German mind, so in this, there is no lack of thoroughness, nor of breadth of view and treatment of the subject. The names of the contributors of the various articles are alone sufficient to inspire trust in what they have to tell us. A few of that old band of chemists who made the first *Handwörterbuch* famous still lend their aid to the success of the present volume; while among the younger men are Fittig, Kekulé, Hofmann, Victor Meyer, Tollens, Zincke, and others, who have already made for themselves a name in science.

Whether this be the proper time for the publication of a large and all-embracing treatise on chemistry is perhaps a question which admits of more than one answer. Chemical theories at present seem to be nearing that stage at which they are to be embraced within the larger theories of mechanical science. If this be true, the interpretation to be put upon chemical facts will in some years be greatly modified, and hence the publication of somewhat elaborate treatises will be demanded. In such a

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volume, however, as this, we have the material out of which the chemist of the future will elaborate his general theory of chemical action; and not only this, but we have a storehouse from which the student of our science may draw rich supplies of knowledge, and to which he may always refer, well assured that he will not be sent away empty.

The arrangement of the new *Handwörterbuch* is very similar to our own "Watts' Dictionary." Amid the variety and excellence of the articles, it is difficult to choose any for special mention.

The articles on Equivalents and Atoms are especially to be commended, the former by Prof. Kekulé, the latter by Prof. Fittig. In the former article the author defines the correct and true meaning of the word "equivalent"; he shows how vague oftentimes are the grounds upon which we pronounce that such a substance is equivalent to such another, and he clearly points out the great advantages possessed by the modern atomic notation as compared with the old and vague so-called equivalent notation.

In the article on Atoms we have a clear and succinct account of the modern chemical theory, and an interpretation of the way in which the older ideas of equivalency are applied to the newer atomic doctrines.

The articles on Analysis are generally full and satisfactory. It is strange, however, that such an excellent method of qualitative testing as that presented by "Bunsen's Flame Reactions" should be overlooked.

There are excellent monographs on Aniline and Benzol, by Prof. Hofmann and Zincke respectively; while on such subjects as the Respiration of Animals and Plants, and Zoö-chemistry in general, we have articles from the pen of Prof. v. Gorup-Besanez. The woodcuts are admirable; in this respect the German work is far ahead of our English Dictionary. Let us hope that the work will be completed as promised in the prospectus, and that the volume already published will not add another to the already too long list of great German scientific works the opening volumes of which stand waiting for their successors, but seemingly waiting in vain.

M. M. PATTISON MUIR

OUR BOOK SHELF

Die fossilen Bryozoen des österreichisch-ungarischen Miocäns. Von Prof. Dr. A. E. Ritter von Reuss. I. Abtheilung. Pp. 50. 4to. (Wien: 1874.)

Geologischer Bau der Insel Samothrake. Von Rudolf Hoernes. Pp. 12. 4to. (Wien: 1874.)

THESE publications are extracted from the Transactions of the Imperial Academy of Sciences. Dr. v. Reuss's paper describes the Salicornaridæ, Cellularidæ, and Membraniporidæ, a number of the species being new; and gives twelve excellent plates of the fossils. According to Herr Hoernes, the island of Samothraki consists of abrupt hill-masses of ancient crystalline rocks, such as granite, clay-slate, hornblende rock, &c., overlaid, especially in the north-west and north, with deposits of Eocene age, and diluvial and recent accumulations. A coloured sketch-map accompanies the paper.

Über die palaeozoischen Gebilde Podoliens und deren Versteinerungen. Von Dr. Alois v. Alth. Erste Abtheilung. Pp. 78. (Wien: 1874.)

Über die triadischen Pelecypoden-Gattungen, "Daonella" und "Halobia." Von Dr. E. Mojsisovics v. Mojsvár. Pp. 38. (Wien: 1874.)

BOTH these publications are issued by the Austro-Hungarian Geological Survey, being extracted from the "Abhandlungen, Band vii." This mode of republishing in a separate form the papers contributed to their Transactions cannot be too strongly commended. Dr. A. v. Alth's paper relates to the region which lies between the rivers Bug and Dnieper. It is illustrated by five lithographic plates of fossils, a number of which are new species of Pteraspis, Scaphaspis, Cyathaspis, Beyrichia, &c. Dr. Mojsisovics' paper is also illustrated by five lithographic plates of a number of new species of the genera Daonella and Halobia, which are described and named by himself.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

On the Inventor of Clock Movement applied to Equatorials.—Suum Quique

IN a pamphlet by Col. Laussedat, "On the Horizontal Astronomical Telescope," in which he claims for himself the invention of applying a heliostat to direct the light of any object into a fixed telescope, I find at p. 2 this statement in speaking of the equatorial: "The idea of so endowing a telescope with a moving power which annuls, or, to speak more exactly, compensates the motion of the earth, is due to a French watchmaker of the last century, named Passemont."

I am sure the distinguished writer would not knowingly have done to another the injustice of which in his own case he complains; but in fact this invention belongs to a much earlier date, and to one of far greater fame, the illustrious Robert Hooke, who describes it, with a figure, in his "Animadversions on the Machina Cœlestis of Hevelius" (my copy bears date 1674). It was primarily intended to facilitate the process of measuring directly the distance of two stars, a process which was then much in vogue, but which must have been very troublesome from the difficulty of following them. It consists of a strong polar axis, adjusted at its lower bearing by screws, and carrying at top a cross arm, one end of which bears a counterpoise, and the other a quadrant or sextant with a ball-and-socket support, by which its plane can be made to coincide with that passing through two stars. But Hooke expressly stated that a telescope may be similarly attached there. The polar axis carries an octant whose limb is ratched, and driven by a screw connected with a clock. The clock is regulated by a conical pendulum; and he describes the mode of altering its rate for the sun, moon, and planets. Of the date or details of M. Passemont's re-invention there is no trace in Lalande. But, as I find in Rees' Cyclopædia (art. "Passemont") that he was born in 1702, and that his first publication appeared in 1738, it is by at least half a century later than Hooke's.

It also deserves notice that Col. Laussedat's invention is described by Hooke in his treatise on Helioscopes two years later (1676). His words are: "I explained at the same time to the Royal Society several other ways of facilitating the use of very long glasses for other objects in the heavens (he had been speaking of the sun) by the help of one reflecting plate only, and that was by a tube fixed either perpendicularly, horizontally, or obliquely; for it mattered not, whether as to the seeing the object in any part of the heaven, and the object could be as easily found as by the common telescope of the same length. But of these elsewhere."

I have not, however, been able to find any further notice of it in his works.

This invention leads me to a suggestion which may be interesting to astronomers. The Royal Society possesses two Hüyghenian object-glasses, one of 120 feet focal length, the other of 200. Some years ago a question was raised by M. O. Struve as to the defining power of the first-named of these, in reference to a discussion on the rings of Saturn, and the Society appointed a committee to examine. It was tried at the Kew Observatory, and defined a watch-dial as well as a good 3·75-inch achromatic. This was considered sufficient without incurring the great expense of such a scaffolding or building as would have been required to use it for celestial observations. These, however, can be easily managed by Col. Laussedat's arrangement. If successful, these

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